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14. ABSTRACT Solar and stellar minima represent times of low magnetic activity and simple helio/asterospheres. They are thus excellent targets for interdisciplinary, system-wide studies of the origins of stellar variability and consequent impacts on planetary systems. The recent solar minimum lasted longer and was "quieter" than any we have observed in the Space Age, inspiring both scientific and public interest. It also extends our knowledge of the dynamic range of solar activity and how it affects space weather to unprecedented low levels. A rich variety of satellite and ground-based observations, in conjunction with theoretical and numerical modeling advances, have allowed us to probe the peculiarities of this minimum as never before. The implications are far-reaching, connecting Earth to Sun to stars, radio to X-ray to cosmic rays, and the plethora of observations of recent minima to the Sun's past behavior as preserved in cosmogenic isotopes and historical sunspot and auroral records.					
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# IAU Symposium 286: Comparative Magnetic Minima: Characterizing quiet times in the Sun and stars

3-7 October 2011, Mendoza, Argentina

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## Symposium Program

[\(Click here for the Abstract Book in PDF format\)](#)

### Sunday 2 October

16:30 - 18:30 **Registration** (at the auditorium)

20:30 - 23:30 **Icebreaker** (at Huentala Hotel's Kitek Cava Lounge)

### Monday 3 October

8:30 - 9:20 **Registration**

9:20 - 9:40 **Welcome Words**

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#### **Session 1 - Solar and Stellar Minima** (Chairs: Hebe Cremades, Sarah Gibson)

9:40 - 10:25 **Keynote Talk** - *The Nature and Significance of Solar Minima* **Eric Priest** ([Presentation file](#))

10:25 - 10:55 **Invited Talk** - *Solar and Stellar Activity Diagnostics and Indices* **Michael Thompson** ([Presentation file](#))

10:55 - 11:25 **Coffee break**

11:25 - 11:45 **Solicited Talk** - *How Well Do We Know Sunspot Number?* **Leif Svalgaard** ([Presentation file](#))

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#### **Session 2 - Dynamos and Cycle Variability** (Chairs: Daniel Gómez, Gustavo Guerrero)

11:45 - 12:15 **Invited Talk** - *Dynamo Action and Magnetic Activity in the Sun and Stars* **A. Sacha Brun** ([Presentation file](#))

12:15 - 12:45 **Invited Talk** - *Cycles and Cycle Modulation in Large-Scale Turbulent Dynamos* **Axel Brandenburg**

12:45 - 13:00 **Contributed Talk** - *Magnetic Helicity Fluxes and their Effect on the Solar Dynamo* **Simon Candelaresi, A. Brandenburg** ([Presentation file](#))

13:00 - 15:00 **Lunch break**

15:00 - 15:30 **Invited Talk** - *Kinematic Dynamo Models of the Solar Cycle: Past, Present, and Future* **Dibyendu Nandi** ([Presentation file](#))

15:30 - 16:00 **Invited Talk** - *Global MHD Simulations of Stellar Dynamos and the Ingredients for Large-scale*

*Field Organization* Matthew Browning, B. Brown, M. Miesch, et al. ([Presentation file](#))

16:00 – 16:15 *Contributed Talk - Dynamo Action and Magnetic Buoyancy in Convection Simulations in Simulated Tachoclines* Gustavo Guerrero, P. Käpylä ([Presentation file](#))

16:15 – 16:30 *Contributed Talk - Tayler Instability and Stellar Magnetic Fields* Fabio del Sordo, A. Brandenburg ([Presentation file](#))

16:30 – 16:45 *Contributed Talk - Understanding the Origin of the Extended Minimum of Sunspot Cycle 23* Andrés Muñoz-Jaramillo, D. Nandy, P.C.H. Martens ([Presentation file](#))

16:45 – 17:15 *Coffee break*

17:15 – 19:00 *Poster Session*

## **Tuesday 4 October**

8:15 – 9:15 *Registration*

### **Session 2 – Dynamos and Cycle Variability** (Chairs: Daniel Gómez, Gustavo Guerrero)

9:15 – 9:45 *Invited Talk - Helioseismic Probing of Dynamo Related Flows* Michael Thompson (on behalf of Frank Hill) ([Presentation file](#))

9:45 – 10:00 *Contributed Talk - Analyzing the Evolution of the Photospheric Magnetic Field in Terms of Spherical Harmonics and Consequences for the Solar Dynamo* Marc DeRosa, A.S. Brun, J.T. Hoeksema ([Presentation file](#))

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### **Session 3 – Comparative Solar Minima from Sun to Earth** (Chairs: Margit Haberreiter, Andrey Tlatov, David Webb)

10:00 – 10:30 *Invited Talk - Helioseismology: A View of the Solar Interior* Yvonne Elsworth ([Presentation file](#))

10:30 – 10:45 *Contributed Talk - Reconstruction of Magnetic Field Surges to the Poles from Sunspot Impulses* Nadezhda Zolotova, D.I. Ponyavin ([Presentation file](#))

10:45 – 11:15 *Coffee break*

11:15 – 11:45 *Invited Talk - Total Solar Irradiance, Absolute Value and an Estimate of a Long-term Trend from Minimum to Minimum* Werner Schmutz, A. Fehlmann, W. Finsterle, M. Suter ([Presentation file](#))

11:45 – 12:00 *Contributed Talk - The Ni I Lines in the Solar Spectrum* Mariela Vieytes, P. Mauas, J. Fontenla ([Presentation file](#))

12:00 – 12:15 *Contributed Talk - Modeling the Solar EUV Variability* Margit Haberreiter ([Presentation file](#))

12:15 – 12:30 *Contributed Talk - The Use of 17 GHz Radio Emission to Characterize the Solar Minimum* Caius Selhorst, L. Svalgaard, C.G. Giménez de Castro, et al. ([Presentation file](#))

12:30 – 13:00 *Invited Talk - Polar Magnetic Fields and Coronal Holes during the Recent Solar Minima* Giuliana de Toma ([Presentation file](#))

13:00 – 15:00 *Lunch break*

15:00 – 15:30 **Invited Talk** - *Global Magnetic Fields: Variation of Solar Minima* **Andrey Tlatov**, V.N. Obridko  
([Presentation file](#))

15:30 – 16:00 **Invited Talk** - *The 3D Solar Minimum Corona with Differential Emission Measure Tomography*  
**Alberto Vásquez**, R.A. Frazin, Z. Huang, et al. ([Presentation file](#))

16:00 – 16:15 **Contributed Talk** - *Solar Cycle 23 and 24 Minima Seen through the Eyes of Coronal MHD Models*  
**Jon Linker**, Z. Mikic, P. Riley, et al. ([Presentation file](#))

16:15 – 16:30 **Contributed Talk** - *Large-scale Photospheric Flow Patterns around Coronal Structures* **Neal Hurlburt** ([Presentation file](#))

16:30 – 16:45 **Contributed Talk** - *The Role of Streamers in the Deflection of Coronal Mass Ejections: Comparison between STEREO 3D Reconstructions and Numerical Simulations* **Francesco Zuccarello**, A. Bemporad, C. Jacobs, et al. ([Presentation file](#))

16:45 – 17:15 **Coffee break**

17:15 – 17:45 **Invited Talk** - *The Structure of the Heliosphere in Solar Minima and Consequences on Interplanetary Flux Rope Properties* **Sergio Dasso**, A.M. Gulisano, P. Démoulin ([Presentation file](#))

17:45 – 18:00 **Contributed Talk** - *Coronal Transients during Two Solar Minima: Their Source Regions and Interplanetary Counterparts* **Hebe Cremades**, C.H. Mandrini, S. Dasso ([Presentation file](#))

18:00 – 18:15 **Contributed Talk** - *Dynamo-driven Plasmoid Ejections above a Spherical Surface* **Jörn Warnecke**, A. Brandenburg, D. Mitra ([Presentation file](#))

18:15 – 18:30 **Contributed Talk** - *Dynamic Evolution of Interplanetary Wave Shocks Driven by CMEs* **Pedro Corona Romero**, J.A. González Esparza ([Presentation file](#))

18:30 – 18:45 **Contributed Talk** - *Dynamical Evolution of Anisotropies of the Solar Wind Magnetic Turbulent Outer Scale* **María Emilia Ruiz**, S. Dasso, W.H. Matthaeus, et al. ([Presentation file](#))

## **Wednesday 5 October**

**Session 3 – Comparative Solar Minima from Sun to Earth** (Chairs: Margit Haberreitter, Andrey Tlatov, David Webb)

9:00 – 9:30 **Invited Talk** - *Interplanetary Conditions: Lessons from this Minimum* **Janet Luhmann**, C.O. Lee, P. Riley, et al. ([Presentation file](#))

9:30 – 9:50 **Solicited Talk** - *The Floor in the Solar Wind Magnetic Field: Status Report* **Ed Cliver** ([Presentation file](#))

9:50 – 10:05 **Contributed Talk** - *Long-term Solar Wind Variations and the Coming Solar Minimum* **Ramón López** ([Presentation file](#))

10:05 – 10:35 **Invited Talk** - *Probing the Heliosphere with the Directional Anisotropy of Galactic Cosmic Ray Intensity* **Kazuoki Munakata** ([Presentation file](#))

10:35 – 10:50 **Contributed Talk** - *Search for Solar Energetic Particles Signals on Mexico City Neutron Monitor Database* **Bernardo Vargas**, J.F. Valdés Galicia ([Presentation file](#))

10:50 – 11:15 **Coffee break**

11:15 – 11:45 **Invited Talk** - *On the Cause of Extremely Low Geomagnetic Activity during the Recent Deep*

*Solar Cycle Minimum* Ezequiel Echer, B. Tsurutani, W.D. González ([Presentation file](#))

11:45 – 12:00 Contributed Talk – *WHI in the Context of a Long and Structured Solar Minimum: An Overview of Sun-to-Earth Observations* Sarah Gibson, G. de Toma, Y. Elsworth, et al. ([Presentation file](#))

12:00 – 12:30 Invited Talk – *Modeling of the Atmospheric Response to a Strong Decrease of the Solar Activity* Eugene Rozanov, T. Egorova, A. Shapiro, W. Schmutz ([Presentation file](#))

12:30 – 13:00 Invited Talk – *Ionosphere and Upper Atmosphere under the Extremely Prolonged Low Solar Activity of Solar Cycle 23 /24* Inez Batista, C.M.N. Candido, C. Brum, M.A. Abdu ([Presentation file](#))

13:00 – 15:00 Lunch break

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#### **Session 4 – Stellar Cycles** (Chairs: Cristina Mandrini, Adriana Válio)

15:00 – 15:30 Invited Talk – *Stellar cycles: General Properties and Future Directions* Mark Giampapa ([Presentation file](#))

15:30 – 16:00 Invited Talk – *Investigating Stellar Surface Rotation Using Observations of Starspots* Heidi Korhonen ([Presentation file](#))

16:00 – 16:20 Solicited Talk – *Modulated Stellar and Solar Cycles: Parallels and Differences* K. Oláh, Lidia van Driel-Gesztelyi ([Presentation file](#))

16:20 – 16:35 Contributed Talk – *The Solar Wind in Time: Internal and External Forcing* Jeffrey Linsky, B. Wood, S. Redfield ([Presentation file](#))

16:35 – 16:50 Contributed Talk – *Stellar Activity Cycles in a Model for Magnetic Flux Generation and Transport* Emre Isik ([Presentation file](#))

16:50 – 17:15 Coffee break

17:15 – 19:00 Poster Session

### **Thursday 6 October**

#### **Session 4 – Stellar Cycles** (Chairs: Cristina Mandrini, Adriana Válio)

9:00 – 9:30 Invited Talk – *Magnetic Activity among Cool Stars in the HR-diagram* Jürgen Schmitt

9:30 – 9:45 Contributed Talk – *On the Origin of Stellar Magnetic Fields* Raphael Steinitz, J. Portnoy ([Presentation file](#))

9:45 – 10:15 Invited Talk – *Semi-empirical Modeling of Solar/Stellar Magnetic Cycles* Adriana Válio ([Presentation file](#))

10:15 – 10:30 Contributed Talk – *The Rotation-activity Connection in Young Low Mass Stars* Jenny Rodríguez Gómez, O. Restrepo Gaitán, M. Cuervo Osés, G. Pinzón Estrada ([Presentation file](#))

10:30 – 10:50 Solicited Talk – *12 Years of Stellar Activity Observations in Argentina* Pablo Mauas, A. Buccino, R. Díaz, et al. ([Presentation file](#))

10:50 – 11:15 Coffee break

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#### **Session 5 – Grand Minima and Historical Records** (Chairs: Alisson Dal Lago, Ilya Usoskin)

11:15 – 11:45 **Invited Talk** – *Stars in Magnetic Grand Minima: Where Are They and What Are They Like?* Steven Saar ([Presentation file](#))

11:45 – 12:00 **Contributed Talk** – *Soft X-ray Emission as Diagnostics for Maunder Minimum Stars* Katja Poppenhäger, J.H.M.M. Schmitt ([Presentation file](#))

12:00 – 12:15 **Contributed Talk** – *Is the Small-scale Quiet Sun Dynamo a Pedestal for Solar (and Stellar) Activity?* Karel Schrijver ([Presentation file](#))

12:15 – 12:35 **Solicited Talk** – *Interplanetary Space Weather and Space Climate Prediction: Opportunities* Madhulika Guhathakurta

12:35 – 14:30 **Lunch break**

14:30 **Excursion followed by Conference Dinner** (see [Social Program](#))

## **Friday 7 October**

**Session 5 – Grand Minima and Historical Records** (Chairs: Alisson Dal Lago, Ilya Usoskin)

9:00 – 9:30 **Invited Talk** – *Dynamo Models of Grand Minima* Arnab R. Choudhuri ([Presentation file](#))

9:30 – 9:50 **Solicited Talk** – *A Simple Dynamo Model for Grand Minima and Geomagnetic Reversals* Dmitry Sokoloff, G. Sobko, V. Trukhin, V. Zadov ([Presentation file](#))

9:50 – 10:05 **Contributed Talk** – *Is Meridional Circulation Important in Modeling the Irregular Solar Cycle?* Bidya Karak, A.R. Choudhuri ([Presentation file](#))

10:05 – 10:35 **Invited Talk** – *Grand Minima of Solar Activity on Long-term Scales* Ilya Usoskin, S.K. Solanki ([Presentation file](#))

10:35 – 10:50 **Contributed Talk** – *Geomagnetic Storms and Solar Activity since 1806* Volker Bothmer, E. Bosman ([Presentation file](#))

10:50 – 11:15 **Coffee break**

11:15 – 11:45 **Invited Talk** – *Historical Records of Solar Grand Minima: A Review* José Vaquero ([Presentation file](#))

11:45 – 12:15 **Invited Talk** – *Does Solar Activity Affect Climate?* Blanca Mendoza ([Presentation file](#))

12:15 – 12:45 **Invited Talk** – *Effects of Solar Variability on Planetary Plasma Environments and Habitability* César Bertucci ([Presentation file](#))

12:45 – 13:00 **Contributed Talk** – *EV-Lac as a Potential Host for Habitable Planets* Ximena Abrevaya, E. Cortón, P. Mauas

13:00 – 14:30 **Lunch break**

14:30 – 15:00 **Invited Talk** – *Variations of Solar and Cosmic Ray Cycles at the Maunder Minimum* Hiroko Miyahara, Y. Yokoyama, Y.T. Yamaguchi, et al. ([Presentation file](#))

**Discussion and Summary** (Chair: Cristina Mandrini)

15:00 – 16:00 **Discussion** led by Karel Schrijver *Can We Establish if We Are Entering a Grand Minimum, and to Whom would that Matter?* ([Presentation file](#))

16:00 – 16:15 **Publication Plans - Meeting Summary** Cristina Mandrini & David Webb – Hebe Cremades & Sarah Gibson

## Public Outreach Talk

17:30 - 18:30 **Public Outreach Talk - Global Warming: Greenhouse Effect or Solar Activity? - Calentamiento Global: ¿Efecto Invernadero o Actividad Solar?** Pablo Mauas (the talk will be given in Spanish)

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## Poster Contributions

**S2 – P1 Solar Grand Minima and On-Off Intermittent Dynamo** Abraham C.-L. Chian, A. Brandenburg, M.R.E. Proctor, E.L. Rempel

**S2 – P2 Plasma Flow vs. Magnetic Feature Tracking Speeds in the Sun** G. Guerrero, Matthias Rheinhardt, A. Brandenburg, M. Dikpati

**S2 – P3 The Butterfly Diagram Structure in the Minimal Activity Phases** Maurizio Ternullo, P. Romano

**S2 – P4 Creating a database and Analysis of Sunspots at the Solar Observatory of Ica National University in Peru** Lurdes Martínez Meneses, M. Ishitsuka, J. Ishitsuka, H. Trigo

**S3 – P5 Study of Ground Cosmic Ray Periodicities during Solar Minimum Using the Multidirectional Muon Detector at the Southern Space Observatory** Alisson Dal Lago, L. Ramos Vieira, N.J. Schuch, N.R. Rigozo

**S3 – P6 Long-term Variation of Solar Wind Parameters and their Geoeffectiveness** Vidya C. Dwivedi, D.P. Tiwari, S.P. Agrawal

**S3 – P7 Observations of Coronal Holes during Two Solar Minima** Heidy Gutiérrez, L. Taliashvili

**S3 – P8 Coronal Mass Ejection Deflection in the Corona during the Last Two Solar Minima** Fernando M. López, H. Cremades, L. Balmaceda

**S3 – P9 A Cellular Automaton Model for Coronal Heating** Marcelo López Fuentes, J.A. Klimchuk

**S3 – P10 Magneto-seismology of Solar Atmospheric Loops in the Solar Minimum** Marialejandra Luna-Cardozo, G. Verth, R. Erdélyi

**S3 – P11 High Speed Streams in the Solar Wind during the Last Solar Minimum** G. Maris, O. Maris, Constantin Oprea, M. Mierla

**S3 – P12 Geomagnetic Effects on Cosmic Ray Propagation under Different Conditions** J.J. Masías Meza, X. Bertou, Sergio Dasso

**S3 – P13 Forbush Decreases not Related to Transient Solar Events** Guadalupe Muñoz Martínez, J.F. Valdés Galicia

**S3 – P14 The 3D Solar Corona Cycle 24 Rising Phase from SDO/AIA Tomography** Federico Nuevo, A.M. Vásquez, R.A. Frazin, Zhenguang Huang, W.B. Manchester

**S3 – P15 Earth-directed Coronal Mass Ejections and their Geoeffectiveness during the 2007 – 2010 Interval** Constantin Oprea, M. Mierla, G. Maris

**S3 – P16 Evolution of a Very Complex Active Region during the Decay Phase of Cycle 23** Mariano Poisson, M. López Fuentes, C.H. Mandrini, et al.



S3 - P17 *Cosmic Ray Particles Behavior during the Last Solar Minimum* Marlos Rockenbach Da Silva, A. Dal Lago, W.D. González, et al.

S3- P18 *Radio Signatures Associated with the Origin of LASCO/STEREO CMEs* Carolina Salas Matamoros, L. Taliashvili

S3- P19 *Very Intense Geomagnetic Storms: Solar Sources, Characteristics and Cycle Distribution* Natalia Szajko, G. Cristiani, C.H. Mandrini, A. Dal Lago

S3 - P20 *A Solar Station in Ica: A Research Center to Improve Education at the University and Schools* Raul Terrazas Ramos, M. Ishitsuka, J. Ishitsuka, H. Trigos

S4 - P21 *Solar Radius and Limb Brightening Variability in the Submillimetric Range* Laura A. Balmaceda, A. Válio, C.L. Selhorst

S4 - P22 *A Statistical Analysis of the  $H\alpha$  - Ca II K Relation for Solar Type Stars of Different Activity Levels* A.P. Buccino, Mariela C. Vieytes, P.J.D. Mauas

S4 - P23 *Determination of the Effective Temperature from  $H\alpha$  Spectral Line Analysis of Solar Type Stars* Deysi Cornejo Espinoza, I. Ramírez, P. Barklem, W. Guevara Day

S4 - P24 *Calibrating the Sun-as-a-star: Using Hinode XRT to Measure Stellar Coronae* Steven H. Saar, P. Testa

S5 - P25 *Potential Energy Stored by Planets and Grand Minima Events* Rodolfo Cionco

S5 - P26 *A new Imminent Grand Minima?* Rodolfo Cionco, R.H. Compagnucci

S5 - P27 *Long-term Relation between Sunspot Activity and Surface Temperature at Different Geographical Regions* M.P. Souza Echer, Ezequiel Echer, W.D. González, et al.

S5 - P28 *Parallels among the "Music Scores" of Solar Cycles, Space Weather and Earth's Climate* Z. Kolláth, K. Oláh, Lidia van Driel-Gesztelyi

S5 - P29 *TTVs Detection in Southern Hemisphere Stars* Romina Petrucci, A.P. Buccino, E. Jofré, et al.

S5 - P30 *Climate Interaction Mechanism between Solar Activity and Terrestrial Biota* Jaime Osorio Rosales, B. Mendoza Ortega

S5 - P31 *The Coronae of Ca II HK-selected Magnetic Grand Minima Candidate Stars* Steven H. Saar, P. Testa

### Late Posters

S3 - P32 *Seeing Measurement at Sasahuine Mountain, Moquegua, Peru* M. Huamán, W. Guevara Day, E. Meza, J. Samanes, P. Becerra, Cristian Ferradas

S3 - P33 *Installation and Operation of the Water Cherenkov Detector for the Large Aperture GRB Observatory (LAGO)* L.J. Otiniano Ormachea, Edith Tüeros Cuadros, W. Guevara Day (LAGO collaboration)



COMPARATIVE MAGNETIC MINIMA:  
CHARACTERIZING QUIET TIMES IN THE SUN AND STARS

IAU SYMPOSIUM No. 286

*COVER ILLUSTRATION:*

Mendocinean landscape showing a typical vineyard plantation with the Andes mountains in the background. Surrounded by a mixture of arid and semiarid landscapes, the city of Mendoza and its rural outskirts have been turned into a fertile oasis, sustained by the melting of glaciers and snow and manmade dams, channels, and drains. Also called “The land of Sun and good wine”, its diaphanous skies and wine-producing fields attract over a million tourists every year.

Our Mendoza IAU Symposium on “Comparative Magnetic Minima” brought together scientists who studied the Sun, stars, and effects of magnetic activity on planetary space environments. One such “space weather” effect is that of beautiful aurorae, as illustrated here on a star field background courtesy of NASA and The Hubble Heritage Team (STScI/AURA). The solar disc image is courtesy of SDO (NASA) and the AIA consortium, while the solar corona is courtesy of Williams College Eclipse Expedition (Jay M. Pasachoff, Muzhou Lu, and Craig Malamut), captured on July 11, 2010.

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##### The Spectral Energy Distribution of Galaxies (SED2011)

R. J. TUFFS, *MPI für Kernphysik, Astrophysics Dept, Saupfercheckweg 1, 69117 Heidelberg,  
Germany*

#### IAUS 285

##### New Horizons in Time-Domain Astronomy

R. E. M. GRIFFIN, *NRC Dominion Astrophysical Observatory, 5071 W Saanich Rd, Victoria,  
BC, V9E 2E7, Canada*

#### IAUS 286

##### Comparative Magnetic Minima: Characterizing Quiet Times in the Sun and Stars

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1428 Buenos Aires, Argentina*

INTERNATIONAL ASTRONOMICAL UNION  
UNION ASTRONOMIQUE INTERNATIONALE

International Astronomical Union



# COMPARATIVE MAGNETIC MINIMA: CHARACTERIZING QUIET TIMES IN THE SUN AND STARS

PROCEEDINGS OF THE 286th SYMPOSIUM OF THE  
INTERNATIONAL ASTRONOMICAL UNION  
HELD IN MENDOZA, MENDOZA, ARGENTINA  
OCTOBER 3–7, 2011

Edited by

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## Preface

IAU Symposium 286, “Comparative Magnetic Minima: Characterizing Quiet Times in the Sun and Stars”, was coordinated through Division II, with the strong support of Division IV, including several of their associated commissions. It was held in Mendoza, Argentina, from 3 to 7 October 2011, and attracted nearly 100 scientists expert on various pertinent topics from 23 countries. The goal of the symposium was to consider solar and stellar minima, from generative dynamo mechanisms to in-depth analyses from Sun to Earth for recent well-observed and modeled minima, to a range of stellar cyclic activity, to outlier “grand minima”. Solar, heliospheric, geospace, atmospheric, stellar, and planetary sciences were included in the meeting’s scope.

Solar and stellar minima represent times of low magnetic activity and simple helio/asterospheres. They are, thus, excellent targets for interdisciplinary, system-wide studies of the origins of stellar variability and consequent impacts on planetary systems. The recent solar minimum extended longer and was “quieter” than any we have observed in the Space Age, inspiring both scientific and public interest. A rich variety of satellite and ground-based observations, in conjunction with theoretical and numerical modeling advances, have allowed us to probe the peculiarities of this minimum as never before. The implications are far-reaching, connecting Earth to Sun to stars, radio to ~~X-ray~~ to cosmic rays, and the plethora of observations of recent minima to the Sun’s past behavior as preserved in cosmogenic isotopes and historical sunspot and auroral records.

At the meeting, the keynote talk on “The nature and significance of solar minima” was given by Eric Priest. This was followed by 28 invited, 6 solicited talks and 28 contributed presentations spread over five sessions: Solar and Stellar Minima, Dynamos and Cycle Variability, Comparative Solar Minima from Sun to Earth, Stellar Cycles and Grand Minima, and Historical Records. A closing discussion on whether we are entering a grand minimum was led by Karel Schrijver. Thirty one poster presentations were put up and remained during the entire meeting. A public outreach talk on global warming and solar activity was given by Pablo Mauas at the end of the symposium.

The presentations described how magnetic fields can be cyclically generated in solar and stellar interiors via various dynamo processes. Numerical models have increased in complexity to the point where many observed aspects of the cycles in the Sun and stars are captured, although mysteries remain such as the origins of extended, or “grand” minima. Both stellar observations and historical and cosmogenic records at the Earth were presented, forming a basis of understanding of such intervals, and of solar/stellar long-term variability in general. A simple method to reconcile the Zürich Sunspot Number and the Group Sunspot Number was presented, with important and wide ranging implications towards an agreed-upon and vetted single sunspot series for use in the future.

The recent extended minimum was the lowest and longest minimum in about a century, having weak polar magnetic fields, a complex corona and heliosphere, and recurrent high-speed streams. Simultaneously, it was found that solar minima do not all look alike, given that the Sun can have different magnetic flux configurations even during very quiet times, yielding distinct 3D magnetic flux distributions and, therefore, diverse structure of the corona and heliosphere. During this recent minimum, the solar magnetic field achieved a solar maximum-like corona and solar wind source situation, but with weak magnetic fields and associated weak heating. The discussed results point out the need for textbooks and solar physics educators to revise the way they describe the solar wind and its sources.

In addition, the recent minimum provoked discussions on the possibility of a trend in the Sun's current magnetic cycles towards a grand minimum and the potential implications for the Earth's climate. For instance, there is evidence that a strong decrease of solar activity can lead to a delay of ozone recovery, partially compensating greenhouse warming, and that irradiance variability is the most important forcing for global problems. A combination of the bottom-up and top-down models seems appropriate for radiative solar forcing of the atmosphere. Although the forcing due to anthropogenic influences is about seven times larger than the radiative solar forcing, solar activity certainly does affect climate, and all relevant observations need to be maintained or extended.

The question of the origins and implications of cyclic behavior, for the Sun-Earth system and also for other stellar-planetary systems, was the subject of several presentations. For instance, it was shown that induced magnetospheres directly interact with the solar wind and, therefore, are more prone to atmospheric evolution than intrinsic magnetospheres.

This symposium was undoubtedly unique in the sense that it brought together a diverse group of scientists that were able to take part in discussions, appreciate the scientific disciplines of others, and discover the common aspects of the physical processes involved in the different studied environments from Sun to Earth, and stars to planets. The editors take this opportunity to thank Germán Cristiani and Marcelo López-Fuentes for their valuable assistance in preparing this volume. We also are grateful to the following reviewers who assisted us in improving the papers: Drs. Thomas Ayres, Alisson Dal Lago, Sergio Dasso, Marcelo López-Fuentes, Daniel Gómez, Manuel Güdel, Gustavo Guerrero, Jeffrey Hall, Margit Haberreiter, Kanya Kusano, Georgeta Maris, Leif Svalgaard, Andrey Tlatov, Ilya Usoskin, Adriana Valio, and Alberto Vásquez. Please note that many of the papers contain color figures, which are printed here in black and white but which can be viewed online in color.

*Sarah Gibson and Hebe Cremades, co-chairs SOC*

*Cristina H. Mandrini, chair LOC*

*Cristina H. Mandrini and David F. Webb, Proceedings Editors*

*Buenos Aires, Argentina, 29 March 2012*

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The Local Organizing Committee operated under the auspices of the Instituto de Astronomía y Física del Espacio (IAFE) and the Universidad Tecnológica Nacional - Facultad Regional Mendoza (UTN-FRM).

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